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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/700,722	11/03/2003	Sunder Rathnavelu Raj	NLMIP041	6031
25670 7590 07/22/2008 WILLIAM L. PARADICE, III 4880 STEVENS CREEK BOULEVARD SUITE 201 SAN JOSE, CA 95129				
EXAMINER				
PYO, MONICA M				
ART UNIT		PAPER NUMBER		
2161				
MAIL DATE		DELIVERY MODE		
07/22/2008		PAPER		

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/700,722

Applicant(s)

RAJ, SUNDER RATHNAVELU

Examiner

MONICA M. PYO

Art Unit

2161

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 April 2008.
2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-16, 19-23, 25-29, 45, 46 and 49 is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5) ☐ Claim(s) _____ is/are allowed.
6) ☒ Claim(s) 1-16, 19-23, 25-29, 45-46 and 49 is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____

DETAILED ACTION

1. This communication is responsive to the Amendment filed 4/21/2008.
2. Claims 1-16, 9-23, 25-29, 45-46 and 49 are currently pending in this application. In the Amendment filed 4/21/2008, claims 17-18, 24, 31-33, 47-48 are canceled and claims 1, 20, 23 and 45 are amended. This action is made Final.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-4, 6, 20-21, 23 and 27-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Non Patent Literature "A versatile Data String-Search VLSI", published by IEEE on April 1988, written by Masaki Hirata et al. (hereinafter Hirata) in view of U.S. Patent No. 7,225,188 issued to Gai et al. (hereinafter Gai), and further in view of U.S. Patent No. 6,785,677 issued to Fritchman (hereinafter Fritchman).

Regarding claims 1 and 23, Hirata discloses a method, comprising:

- A). **receiving a text string having a plurality of characters**, as a search string with characters (Hirata: pg. 329, col. 1, lns. 4-20; pg. 329, col. 2, lns. 30-pg. 330, col. 1, lns. 19; fig. 2); and
- B). **performing an unanchored search of a database of a stored patterns matching one or more characters of the text string using a state machine, wherein the state**

machine comprises a ternary content addressable memory (TCAM), wherein the text string has zero or more wildcard characters, zero or more prefix characters preceding the wildcard characters and zero or more suffix characters succeeding the wildcard characters, and wherein performing the unanchored search comprises, as the nonanchor mode search, the TCAM and character data stored in the CAM (Hirata: pg. 329, col. 2, lns. 1-12 & 18-29; pg. 330, col. 2, lns. 21-33; pg. 331, col. 2, lns. 6-25; pg. 332, col. 1, lns. 1-6; fig. 5):

C). searching the database for a first pattern matching the prefix characters, as a match between input data and stored data (Hirata: pg. 330, col. 1, lns. 1-col. 2, lns. 33; pg. 331, col. 1, lns. 1-17); and

D). searching the database for a second pattern matching the suffix characters, as a match between input data and stored data (Hirata: pg. 330, col. 1, lns. 1-col. 2, lns. 33; pg. 331, col. 1, lns. 1-17),

E). creating a count that equals a number of the suffix characters (i.e., letter A from an example of 'A\$C') plus a number of the wildcard characters (i.e., wildcard \$ from an example of 'A\$C'), as an example of "ASC" for a match from reference words in the CAM (Hirata: pg. 330, col. 2, lns. 21- pg. 331, col. 1, lns. 17)

Hirata does not explicitly disclose the method:

B). wherein the performing comprises comparing a state of the state machine and one of the plurality of characters with contents of a state field and a character field, respectively, stored in the TCAM, wherein the contents of the state field and the character field stored in the TCAM embody state transitions of the state machine,

C)/D)/E). the prefix characters and the suffix characters

However, Gai discloses the method:

B). wherein the performing comprises comparing a state of the state machine and one of the plurality of characters with contents of a state field and a character field, respectively, stored in the TCAM, wherein the contents of the state field and the character field stored in the TCAM embody state transitions of the state machine, as the Deterministic Finite Automation [DFA] has a series of matching arcs and a match of the sequential characters (Gai: col. 10, lns. 9-37 & 63-col. 11, lns. 36; figs. 4, 6-7).

It would have been obvious to a person with ordinary skill in the art at the time of invention to modify the teachings of Hirata with the teachings of Gai to utilize the state machine DFA performing a comparison with the motivation to enhance the pattern matching engine (Gai: col. 4, lns. 16-39).

Hirata and Gai do not explicitly disclose:

C)/D)/E). the prefix characters and the suffix characters

However, Fritchman discloses:

C)/D)/E). the prefix characters and the suffix characters, as the prefix and suffix segments (Fritchman: col. 5, lns. 51-53 and 64-67).

It would have been obvious to a person with ordinary skill in the art at the time of invention to modify the teaching of Hirata and Gai and Stellenberg with the teachings of Fritchman to utilize the prefix and suffix characters in a data stream comparison with the motivation to improve performance of executing pattern matching queries (Fritchman: col. 1, lns. 8-29).

Regarding claim 2, Hirata and Gai and Fritchman disclose the method wherein the state is a next state (Hirata: pg. 329, col. 2, lns. 1-16).

Regarding claim 3, Hirata and Gai and Fritchman disclose the method further comprising receiving the next state from an associated memory (Hirata: pg. 329, col. 2, lns. 1-16).

Regarding claim 4, Hirata and Gai and Fritchman disclose the method wherein the state is an idle state (Hirata: pg. 331, col. 2, lns. 7-17).

Regarding claim 6, Hirata and Gai and Fritchman disclose the method wherein performing the unanchored search comprises:

traversing the state machine with the text string, wherein the state machine is traversed with one of the plurality of characters at a time (Hirata: pg. 330, col. 1); and

transitioning a state of the state machine based on a stored next state (Hirata: pg. 331, col. 2, lns. 6-25; pg. 332, col. 1, lns. 1-6).

Regarding claim 20, Hirata and Gai and Fritchman teaches the method as disclosed in claim 1. Additionally, Hirata disclose wherein the performing further comprises converging all branches of the state machine, for a given stored pattern, to a single next state when a first number of the characters are matched to the contents of a state field to all state transitions of the branches (Hirata: pg. 331, col. 1, lns. 20- pg. 332, col. 2, lns. 5).

Regarding claim 21, Hirata and Gai and Fritchman disclose the method wherein the single next state is an earlier possible next state for at least one of the branches and wherein the converging comprises

transitioning at least one of the branches to the earlier possible next state (Hirata: pg. 331, col. 1, lns. 20-col. 2, lns. 4).

Regarding claim 27, Hirata and Gai and Fritchman disclose the method further comprising:

returning a match result when the first stored pattern matches the prefix characters, the second stored pattern matches the suffix characters, and second number of wildcard characters is variable (Fritchman: col. 3, lns. 35-63; col. 8, lns. 30-67).

Regarding claim 28, Hirata and Gai and Fritchman disclose the method further comprising:

returning a match result when the first stored pattern matches the prefix (Fritchman: col. 3, lns. 35-63; col. 5, lns. 21-22)

characters, the second stored pattern matches the suffix characters, and second number of wildcard characters is fixed (Fritchman: col. 3, lns. 35-63).

Regarding claim 29, Hirata and Gai and Fritchman disclose the method further comprising:

storing a count value that equals a number of the suffix characters plus the fixed second number of the wildcard characters (Hirata: pg. 330, col. 2, lns. 34-pg. 331, col. 1, lns. 10) and (Fritchman: col. 3, lns. 35-63); and

maintaining a count of incoming characters of the text string after receiving the prefix characters (Fritchman: col. 5, lns. 21-22; col. 8, lns. 30-67); and

returning the match result when the maintained count is equal to the stored count value (Fritchman: col. 8, lns. 30-67).

5. Claims 7-16, 19, 25-26, 45-46 and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirata in view of Gai, further in view of Fritchman as applied to claims 1-4, 6, 20-21, 23 and 27-29 above, and further view of U.S. Patent No. 7,134,143 issued to Stellenberg et al. (hereinafter Stellenberg).

Regarding claim 7, Hirata and Gai and Fritchman disclose the method further comprising encoding the next state (Hirata: pg. 330, col. 2, lns. 1-10).

However, Stellenberg discloses: in a lookup table (Stellenberg: col. 4, lns. 7-17; col. 20, lns. 36-49).

It would have been obvious to a person with ordinary skill in the art at the time of invention to modify the teaching of Hirata and Gai and Fritchman with the teachings of Stellenberg to utilize the a lookup table in a searching method with the motivation to enhance the logical combination to better determine whether a portion of the data stream matches one of the patterns of bytes (Stellenberg: col. 2, lns. 46-58).

Regarding claim 8, Hirata and Gai and Fritchman and Stellenberg disclose the method wherein the plurality of characters comprises valid and invalid characters and wherein encoding comprises encoding the next state in the state machine if a valid character is received in the text string (Hirata: pg. 330, col. 2, lns. 1-10; pg. 331, col. 1, lns. 2-10) and (Stellenberg: col. 5, lns. 35-54; col. 20, lns. 36-49).

Regarding claim 9, Hirata and Gai and Fritchman and Stellenberg disclose the method wherein transitioning further comprises transitioning the state machine to a default state if an invalid character is received in the text string (Hirata: pg. 331, col. 2, lns. 7-26-pg. 332, col. 1, lns. 6).

Regarding claim 10, Hirata and Gai and Fritchman and Stellenberg disclose the method wherein the transitioning is stopped when an invalid character is received (Hirata: pg. 332, col. 1, lns. 7-21).

Regarding claim 11, Hirata and Gai and Fritchman and Stellenberg disclose the method wherein performing the unanchored search comprises searching for an exact match of one of the stored patterns (Hirata: pg. 330, col. 2, lns. 21-33) and (Stellenberg: col. 5, lns. 356-54; col. 9, lns. 36-63).

Regarding claim 12, Hirata and Gai and Fritchman and Stellenberg disclose the method wherein performing the unanchored search comprises searching for an inexact match of one of the stored patterns (Hirata: pg. 330, col. 2, lns. 21-33) and (Stellenberg: col. 5, lns. 35-54; col. 9, lns. 36-63).

Regarding claims 13, Hirata and Gai and Fritchman and Stellenberg disclose the method wherein the TCAM has a first width and the text string has a second width greater than the first width of the TCAM (Hirata: pg. 329, col. 2, lns. 1-12) and (Stellenberg: col. 21, lns. 56-col. 22, lns. 3).

Regarding claim 14, Hirata and Gai and Fritchman and Stellenberg disclose the method wherein each of the plurality of characters has a case, and wherein performing the unanchored search further comprises performing the unanchored search insensitive to the case of one or more of the plurality of characters (Hirata: pg. 330, col. 2, lns. 21-33) and (Stellenberg: col. 9, lns. 36-62; col. 17, lns. 31-39).

Regarding claims 15, Hirata and Gai and Fritchman and Stellenberg disclose the method wherein the text string is encoded in a format having a first plurality of bits, wherein one bit of the first plurality of bits corresponds to the case, wherein the contents of the state field has a second plurality of bits and wherein performing the search insensitive to the case comprises (Hirata: pg. 330, col. 2, lns. 34-pg. 331, col. 1, lns. 10) and (Stellenberg: col. 9, lns. 36-62; col. 17, lns. 31-39; col. 20, lns. 36-49; col. 21, lns. 30-55):

Art Unit: 2161

masking out the one bit corresponding to the case (Stellenberg: col. 17, lns. 31-39); and comparing the first plurality of bits with the second plurality of bits (Stellenberg: col. 19, lns. 3-20).

Regarding claims 16, Hirata and Gai and Fritchman and Stellenberg disclose the method wherein performing the search insensitive to the case further comprises transforming the characters of the text string from a first code to a second code, the second code having a bit unused in the comparing (Stellenberg: col. 16, lns. 51-67; col. 17, lns. 31-39).

Regarding claim 19, Hirata and Gai and Fritchman and Stellenberg disclose the method wherein performing the unanchored search comprises:

comparing, in parallel, N number of the characters with the contents of the state field (Hirata: pg. 330, col. 2, lns. 1-10) and (Stellenberg: col. 4, lns. 7-36).

Regarding claim 25, Hirata and Gai and Fritchman do not explicitly disclose the method wherein each of the plurality of characters has a case, and wherein the first and second searches are insensitive to the case.

However, Stellenberg discloses: the method wherein each of the plurality of characters has a case, and wherein the first and second searches are insensitive to the case (Stellenberg: col. 17, lns. 31-39).

It would have been obvious to a person with ordinary skill in the art at the time of invention to modify the teaching of Hirata and Gai and Fritchman with the teachings of

Stellenberg to utilize the case insensitivity in a searching method with the motivation to enhance the searching method to find matching data stream (Stellenberg: col. 2, lns. 46-58).

Regarding claims 26, Hirata and Gai and Fritchman and Stellenberg disclose the method wherein the TCAM has a first width and the text string has a second width greater than the first width (Hirata: pg. 329, col. 1, lns. 4-20) and (Stellenberg: col. 21, lns. 56-col. 22, lns. 3).

6. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirata in view of Gai, further in view of Fritchman as applied to claims 1-4, 6, 20-21, 23 and 27-29 above, and further in view of U.S. Patent No. 5,963,942 issued to Igata (hereinafter Igata).

Regarding claim 5, Hirata and Gai and Fritchman disclose the method wherein the TCAM implements (Hirata: pg. 329, col. 1, lns. 1-20J).

However, Igata discloses: an Aho-Corasick algorithm (Igata: col. 4, lns. 41-65).

It would have been obvious to a person with ordinary skill in the art at the time of invention to modify the teaching of Hirata and Gai and Fritchman with the teachings of Igata to utilize the Aho-Corasick algorithm searching with the motivation to increase efficiency of text searching result (Igata: col. 4, lns. 41-53).

7. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirata in view of Gai and Fritchman and Stellenberg as applied to claims 1-4, 6, 20-21, 23 and 27-29 above, and

further in view of Non-Patent Literature "Fast Routing Table Lookup Using CAMs", published by IEEE on 1993, written by Anthony J. McAuley et al (hereinafter McAuley).

Regarding claim 22, Hirata and Gai and Fritchman and Stellenberg disclose the method further comprising:

storing the characters storage element having a plurality of positions (Hirata: pg. 329, col. 1, lns. 4-20) and (Stellenberg: col. 4, lns. 7-17);
positioning a read pointer at a first position (Stellenberg: col. 6, lns. 18-46); and
adjusting the read pointer to a second position by an amount equal to N minus 1 (Stellenberg: col. 6, lns. 18-46).

However, McAuley discloses:

in a first-in-first-out (FIFO) (McAuley: pg. 1388, col. 1, [6.1]).

It would have been obvious to a person with ordinary skill in the art at the time of invention to modify the teaching of Hirata and Gai and Fritchman and Stellenberg with the teachings of McAuley to utilize the FIFM method in the searching system with the motivation to increase efficiency of text searching result (McAuley: pg. 1382, col. 1, [Introduction]).

8. Claims 45-46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirata in view of Gai, further in view of Fritchman as applied to claims 1-4, 6, 20-21, 23 and 27-29 above, and futher in view of McAuley, and further in view of U.S. Patent No. 5,712,971 issued to Stanfill et al. (hereinafter Stanfill).

Regarding claim 45, Hirata and Gai and Fritchman teaches the method as disclosed in claim 1. Additionally, Hirata discloses the method wherein the control circuitry comprises:

a register coupled to storage element and the TCAM (Hirata: pg. 330, col. 2, lns. 34-pg. 331, col. 1, lns. 10);

circuit coupled to the storage element (Hirata: pg. 329, col. 2, lns. 30-pg. 330, col. 1, lns. 19; fig. 2).

Hirata does not disclose:

the FIFO; a rollback

However, McAuley discloses:

the FIFO, as a first-in-first-out (FIFO) storage element (McAuley: pg. 1388, col. 1, [6.1]); and

It would have been obvious to a person with ordinary skill in the art at the time of invention to modify the teaching of Hirata and Gai and Fritchman with the teachings of McAuley to utilize the FIFM method in the searching system with the motivation to increase efficiency of text searching result (McAuley: pg. 1382, col. 1, [Introduction]).

Hirata and Gai and Fritchman and McAuley do not explicitly disclose:

a rollback.

However, Stanfill discloses: **a rollback** (Stanfill: col. 10, lns. 55-67).

It would have been obvious to a person with ordinary skill in the art at the time of invention to modify the teaching of Hirata and Gai and Fritchman and McAuley with the teachings of Stanfill to utilize the rollback command in a searching method with the motivation to be able to undone the last operation (Stanfill: col. 4, lns. 10-26).

Regarding claim 46, Hirata and Gai and Fritchman and McAuley and Stanfill disclose the apparatus further comprising a processor coupled to the pattern and state database (Hirata: pg. 329, col. 1, lns. 4-30).

9. Claim 49 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirata in view of Gai, in view of Fritchman, further in view of McAuley and further in view of Stanfill as applied to claims 45-46 above, and further in view of Igata.

Regarding claim 49, Hirata and Gai and Fritchman, McAuley and Stanfill disclose the method wherein the TCAM implements (Hirata: pg. 329, col. 1, lns. 1-20)).

However, Igata discloses: an Aho-Corasick algorithm (Igata: col. 4, lns. 41-65).

It would have been obvious to a person with ordinary skill in the art at the time of invention to modify the teaching of Hirata and Gai and Fritchman and McAuley and Stanfill with the teachings of Igata to utilize the Aho-Corasick algorithm searching with the motivation to increase efficiency of text searching result (Igata: col. 4, lns. 41-53).

Response to Arguments

10. Applicant's arguments filed 4/21/2008 have been fully considered but they are not persuasive.

Applicant argues that Hirata in view of Gai, and further in view of Fritchman do not disclose the feature of "creating a count that equals a number of the suffix characters plus a number of the wildcard characters." However, the Examiner disagrees. As stated in the

Art Unit: 2161

rejection above, Hirata clearly discloses in page 331, col. 1, lines 1-10 the example of the data string comparison using an input data string of "A\$C". In this example, Hirata uses a wildcard character (i.e., \$) and a suffix character (i.e., C) to find a matching string of either "ABC" or "AVC" but not "BBC". Although Hirata does not explicitly disclose the claim limitation of "the prefix characters and the suffix characters", Fritchman discloses in col. 5, lns. 51-53 and 64-67 the feature of above limitation. Therefore, one of ordinary skill in the art would clearly recognize that these teachings of Hirata in view of Gai and further in view of Fritchman are equivalent to the claimed feature of counting that equals a number of the suffix characters and a number of the wildcard characters to find a matching string. It should be noted that although the claims are interpreted in light of the specification, limitations from the specification are not read in to the claims. It should be also noted that a reference may be relied upon for all that it would have reasonably suggested to one having ordinary skill in the art, including nonpreferred embodiments. See MPEP 2123 [R-5](1).

Applicant argues that Hirata in view of Gai, and further in view of Fritchman do not disclose the features of "converging all branches of the state machine, for a given stored pattern, to a single next state when a first number of the characters are matched to the contents of a state field to all state transitions of the branches" and "a rollback circuit". As stated in the rejection above, such limitations are taught by Hirata and Stanfill. The Examiner suggests reading the above response in regard to the above claimed limitations. Additionally, it should be noted that the rejections regarding these claims are made under 35 U.S.C. 103(a) and the test for obviousness is whether the combined teaching of the references would have suggested the combination to one of ordinary skill in the art.

Conclusion

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MONICA M. PYO whose telephone number is (571)272-8192. The examiner can normally be reached on Mon & Thur 7:00 - 3:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Apu Mofiz can be reached on 571-272-4080. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2161

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Monica M Pyo
Examiner
Art Unit 2161

mpyo

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Supervisory Patent Examiner, Art Unit 2161